

Pilot's Handbook of Aeronautical Knowledge



U.S. Department
of Transportation
Federal Aviation
Administration



Operational Pitfalls	
Peer pressure	Poor decision-making may be based upon an emotional response to peers, rather than evaluating a situation objectively.
Mindset	A pilot displays mind set through an inability to recognize and cope with changes in a given situation.
Get-there-itis	This disposition impairs pilot judgment through a fixation on the original goal or destination, combined with a disregard for any alternative course of action.
Duck-under syndrome	A pilot may be tempted to make it into an airport by descending below minimums during an approach. There may be a belief that there is a built-in margin of error in every approach procedure, or a pilot may want to admit that the landing cannot be completed and a missed approach must be initiated.
Scud running	This occurs when a pilot tries to maintain visual contact with the terrain at low altitudes while instrument conditions exist.
Continuing visual flight rules (VFR) into instrument conditions	Spatial disorientation or collision with ground/obstacles may occur when a pilot continues VFR into instrument conditions. This can be even more dangerous if the pilot is not instrument rated or current.
Getting behind the aircraft	This pitfall can be caused by allowing events or the situation to control pilot actions. A constant state of surprise at what happens next may be exhibited when the pilot is getting behind the aircraft.
Loss of positional or situational awareness	In extreme cases, when a pilot gets behind the aircraft, a loss of positional or situational awareness may result. The pilot may not know the aircraft's geographical location or may be unable to recognize deteriorating circumstances.
Operating without adequate fuel reserves	Ignoring minimum fuel reserve requirements is generally the result of overconfidence, lack of flight planning, or disregarding applicable regulations.
Descent below the minimum en route altitude	The duck-under syndrome, as mentioned above, can also occur during the en route portion of an IFR flight.
Flying outside the envelope	The assumed high performance capability of a particular aircraft may cause a mistaken belief that it can meet the demands imposed by a pilot's overestimated flying skills.
Neglect of flight planning, preflight inspections, and checklists	A pilot may rely on short- and long-term memory, regular flying skills, and familiar routes instead of established procedures and published checklists. This can be particularly true of experienced pilots.

Figure 2-15. Typical operational pitfalls requiring pilot awareness.

Stressors	
Environmental	Conditions associated with the environment, such as temperature and humidity extremes, noise, vibration, and lack of oxygen.
Physiological stress	Physical conditions, such as fatigue, lack of physical fitness, sleep loss, missed meals (leading to low blood sugar levels), and illness.
Psychological stress	Social or emotional factors, such as a death in the family, a divorce, a sick child, or a demotion at work. This type of stress may also be related to mental workload, such as analyzing a problem, navigating an aircraft, or making decisions.

Figure 2-16. System stressors. Environmental, physiological, and psychological stress are factors that affect decision-making skills. These stressors have a profound impact especially during periods of high workload.



Figure 17-22. At night, the horizon may be hard to discern due to dark terrain and misleading light patterns on the ground.

parallel to another's course. To determine the direction of flight, pilots should observe aircraft lights and their relative position to the horizon. If the intensity of the lights increases, the aircraft is approaching; if the lights dim, the aircraft is moving away.

Size-Distance Illusion

This illusion results from viewing a source of light that is increasing or decreasing in luminance (brightness). Pilots may interpret the light as approaching or retreating.

Fascination (Fixation)

This illusion occurs when pilots ignore orientation cues and fix their attention on a goal or an object. Student pilots tend to have this happen when they are concentrating on the aircraft instruments or attempting to land. They become fixated on one task and forget to look at what is going on around them. At night, this can be especially dangerous because aircraft ground-closure rates are difficult to determine, and there may be minimal time to correct the situation.

Flicker Vertigo

A light flickering at a rate between 4 and 20 cycles per second can produce unpleasant and dangerous reactions. Such conditions as nausea, vomiting, and vertigo may occur. On rare occasions, convulsions and unconsciousness may also occur. Proper scanning techniques at night can prevent pilots from getting flicker vertigo.

Night Landing Illusions

Landing illusions occur in many forms. Above featureless terrain at night, there is a natural tendency to fly a lower-than-normal approach. Elements that cause any type of visual obscurities, such as rain, haze, or a dark runway environment, can also cause low approaches. Bright lights,

steep surrounding terrain, and a wide runway can produce the illusion of being too low with a tendency to fly a higher-than-normal approach. A set of regularly spaced lights along a road or highway can appear to be runway lights. Pilots have even mistaken the lights on moving trains as runway or approach lights. Bright runway or approach lighting systems can create the illusion that the aircraft is closer to the runway, especially where few lights illuminate the surrounding terrain.

Prior to flying at night, it is best to learn and know the challenges of the area in which you are flying in. Study the area and know how to navigate your way through areas that may pose a problem at night. For example, many areas near water may be obscured by low lying clouds or fog. To help deal with this type of situation, it is important to have a plan before you leave the ground. In the daytime, fly the routes and passes that you will be flying at night and determine the minimum altitude you are willing to use at night. If weather prevents you from maintaining the altitude that you planned, make a decision early to turn 180° and land at an alternate airport with better weather conditions. Always consider safer alternatives rather than hope things will work out by taking a chance.

Pilots who fly at night should strongly consider oxygen supplementation at altitudes and times not required by the FAA, especially at night when critical judgment and hand-eye coordination is necessary (e.g., IFR) or if he/she is a smoker or not perfectly healthy.

Enhanced Night Vision Systems

Synthetic Vision Systems (SVS) and Enhanced Flight Vision Systems (EFVS) are two systems that can improve the safety of flight at night. The technology of both is evolving rapidly and being used more and more. [Figure 17-23]



U.S. Department
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Advisory Circular

Subject: General Aviation Controlled Flight
Into Terrain Awareness

Date: 4/1/03

AC No: 61-134

Initiated by: AFS-800

Change:

1. PURPOSE OF THIS ADVISORY CIRCULAR (AC). This AC highlights the inherent risk that controlled flight into terrain (CFIT) poses for general aviation (GA) pilots. This AC includes the Federal Aviation Administration's (FAA) common definition of the term CFIT; identifies some, but not all, of the risks associated with GA CFIT accidents; and provides some recommendations and strategies to combat CFIT within the GA community. This AC is not an all-inclusive document on CFIT; rather, this AC is designed to help flight instructors, FAA Aviation Safety Program Managers, and other trainers develop CFIT training materials by identifying some of the factors involved in GA CFIT accidents. Some common references are included to aid instructors in preparing CFIT presentations. Pilots can benefit from reading this AC to check their own knowledge of CFIT and factors involved to avoid having a GA CFIT accident. This AC will break the study of GA CFIT into three broad categories. One will focus on visual flight rules (VFR) pilots without an instrument rating operating in marginal VFR weather conditions (visual meteorological conditions (VMC)) or instrument flight rules (IFR) weather conditions (instrument meteorological conditions (IMC)) commonly known as scud running. The second category will focus on GA IFR operations in IMC conditions on an IFR flight. The third category will focus on low-flying aircraft operating in VFR conditions. This AC does not address CFIT in Title 14 of the Code of Federal Regulations (14 CFR) part 121 or part 135 operations. The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide clarity to the public regarding existing requirements under the law or agency policies.

2. BACKGROUND.

a. According to FAA information, GA CFIT accidents account for 17 percent of all GA fatalities. More than half of these CFIT accidents occurred during IMC. The FAA is working in partnership with industry to develop an action plan and revise guidance material to reduce the incidence of CFIT within the GA segment of aviation. However, one of the problems in reviewing GA CFIT accidents is the lack of data, particularly human factors data. Since many of the pilots involved in GA CFIT accidents are fatalities and most GA aircraft are not equipped with data recording systems, the lack of GA CFIT accident data will continue to remain a problem for investigators.

b. Although many CFIT accidents have some common factors that are applicable for all types of aircraft, we want to stress the difference between a crewed aircraft with two pilots in the cockpit and a single-pilot aircraft. In crewed cockpits, the second pilot may make the difference between a safe flight and a CFIT accident. Conversely, a second pilot can also be a distraction in certain circumstances unless the crew has been trained to work well together and is following

c. Checklists.

(1) Personal Minimums Checklist,

https://www.faa.gov/training_testing/training/fits/guidance/media/personal%20minimums%20checklist.pdf.

(2) Flight Safety Foundation, CFIT Checklist, Appendix 1, and

https://flightsafety.org/wp-content/uploads/2016/09/cfit_check.pdf. To order a laminated copy, send a written request to The Director of Programs, Flight Safety Foundation, 701 N. Fairfax Street, Suite 250, Alexandria, VA 22314-2058. A fillable Microsoft Excel spreadsheet version of this checklist is available at <https://flightsafety.org/wp-content/uploads/2016/09/FSF-CFIT-Checklist-Worksheet.xls>.

d. Airman Certification Standards and Practical Test Standards. The current versions of these documents are available online at https://www.faa.gov/training_testing/testing/.

e. Controlled Flight Into Terrain Education and Training Aid. Historically, most of the research related to CFIT accidents and the development of recommended safety practices have been done for air carrier type operations. The Controlled Flight Into Terrain Education and Training Aid is a good example of such research done by industry and government. Produced by the Flight Safety Foundation, the International Civil Aviation Organization (ICAO), and the FAA, the aid provides a good history, lists common dangers, and provides some recommended means of combating CFIT accidents for air carrier operations. In addition, the document is a valuable resource for anyone developing a CFIT training course. The document is available online at <https://skybrary.aero/sites/default/files/bookshelf/2507.pdf>.

5. DEFINITIONS.

a. Controlled Flight Into Terrain (CFIT). CFIT occurs when an airworthy aircraft is flown, under the control of a qualified pilot, into terrain (water or obstacles) with inadequate awareness on the part of the pilot of the impending collision.

b. Loss of Control. Loss of control refers to emergency situations from which a pilot may have been able to recover but did not, such as problems with situation awareness, recovery from wind shear, mishandling of an approach, and recovery from a stall.

c. Situational Awareness. As used in this AC, situational awareness means the pilot is aware of what is happening around the pilot's aircraft at all times in both the vertical and horizontal plane. This includes the ability to project the near term status and position of the aircraft in relation to other aircraft, terrain, and other potential hazards.

d. Crewed Aircraft. In this AC, crewed aircraft refers to an aircraft or flight operation in which more than one pilot is required by aircraft certification or type of operation.

e. Single-Pilot Aircraft. In this AC, "single-pilot" means only one pilot is required by the aircraft certification. Normally, only one pilot flies such an aircraft.

Aviation Instructor's Handbook (FAA-H-8083-9)

Chapter 3: The Learning Process

Introduction

The First Flight

When Beverly (learner) enthusiastically presents herself for her first day of flight instruction, Bill, her flight instructor, decides to spend some time in the classroom. Beverly knows a lot of facts about flying and shares her knowledge with Bill, but when he asks questions to test her understanding of the facts, she cannot answer them. During their first flight, Bill discovers Beverly has mastered a few basic skills but her performance is awkward, as if she were working from a list of memorized steps.

In the early stages of flight training, Beverly focuses all her attention on performing each skill. If Bill asks her a question or to perform two tasks at once, she loses her place and needs to restart. As she flies, she makes errors. When she catches herself making an error she becomes visibly frustrated. Then sometimes she does not notice an error and keeps moving ahead as if nothing were amiss. Since she is a beginner, Bill is patient.

The Check Ride

Months later, Bill is helping Beverly prepare for her practical test. Remembering her first days of instruction, Bill feels as if he were working with a different person. The breadth and depth of her classroom knowledge has grown. Beverly does not simply reiterate facts—she applies her knowledge to solve the problems Bill gives her. In addition to meeting all the elements listed in the Airmen Certification Standards (ACS), she also knows about her local environment, such as the nuances of local weather patterns.

In the aircraft, once awkward and tentative actions are now performed with a steady hand and confidence. Skills she struggled to learn in the past have become second nature. When asked to do several things simultaneously, she performs well. When Bill interrupts her, she mentally bookmarks where she is, contends with the interruption and then returns to the task at hand. She still makes errors, but they are small ones that she notices and corrects right away. She still gets frustrated when she makes an error, but she takes a deep breath, and continues on her way. She makes flying look easy and Bill is confident that tomorrow's meeting with the evaluator will go well.

Analysis of the First Flight and Check Ride

Between Beverly's first day of training and the day before her practical test, she has undergone some remarkable changes:

1. She has developed a collection of memorized facts into an in-depth understanding of how to fly and learned to apply this knowledge to problem-solving and decision-making.
2. Skills once performed awkwardly and deliberately are now performed smoothly and efficiently.
3. She comfortably performs several tasks at once, deals with distractions and interruptions, and maintains her focus in demanding situations. Knowledge and skills are now orchestrated.
4. She still makes errors, but they are less frequent, smaller in magnitude, and she quickly identifies and corrects them.
5. Her motivation and enthusiasm remain as high as they were on the first day of training.
6. She displays proficiency in all areas now: those at which she naturally excels as well as those she struggled to master in the past.
7. She deals with psychological obstacles, such as frustration, that initially got in the way of her learning.
8. She recognizes the importance of regular study and practice.

This scenario illustrates the goal of an aviation instructor: to teach each learner in such a way that he or she will become a competent pilot or aviation maintenance technician (AMT). In order to take a pilot or AMT from memorized facts to higher levels of knowledge and skill that include the ability to exercise judgment and solve problems, an instructor needs to know how people learn. Designed as a basic guide in applied educational psychology, this chapter addresses how people learn.

In the flight deck, a pilot is encumbered with any number competing events, tasks, and actions that each demand the attention of the pilot. While the pilot may believe that he or she is successfully managing these many tasks at the same time, in actuality, it is difficult to process more than one thought in congruence. This is especially true when one or more tasks go beyond perceived automation and require cognitive effort. To help reduce the risk of information-processing bottlenecks, it may be necessary for the pilot to employ attention switching.

Continuously switching attention back and forth between two or more tasks is attention switching. For example, when Beverly uses a checklist to perform a preflight inspection, she continuously switches her attention between the checklist and the equipment she is inspecting. She looks at the checklist to retrieve the next step in the procedure, and then looks at the equipment to perform the step.

There is a danger in task switching. The individual may decide that one task is less of a priority than another and choose to postpone resolution of that task. In doing so, it is very easy to simply forget the deferred task completely. Or, should the pilot become momentarily distracted, then effort should be made to remember what task to return to and at what stage of resolution that task was left in. Even the act of managing such tasks is in and of itself a task.

Increased Workload, Diminished Quality

A common response to an overwhelming workload is to reduce the level of standards for quality and achievement. Preemptively evaluating an impending task list to then choose to reduce (or even remove) relatively unimportant tasks can be a safe and effective action against the stresses that often comes with overburdened workload. However, it is not always the case that individuals have the time (or cognitive discipline as referenced in Chapter 2, Human Behavior) to accurately predict what tasks should instead be focused on. Sometimes the individual (especially those inexperienced or under high stress) reverts to a reaction-based response process. This can create a negative environment that may actually induce more stress as the individual continually tries to respond to each task without an overall plan.

Learning to Task Manage

Before learners are asked to perform several tasks at once, instructors should ensure that the learner has devoted enough time to study and practice such that the individual tasks can be performed reasonably well in isolation.

Inexperience with an individual task can often hinder attempts to combine it with other tasks. For example, a learner distracted by trying to interpret unfamiliar symbols on a sectional chart inadvertently deviates from assigned attitude or heading. An instructor recognizes the need to spend more time with these skills in isolation. In this case, there is nothing about the experience of controlling the aircraft that helps learners better understand chart symbols.

Distractions and Interruptions

A distraction is an unexpected event that causes the learner's attention to be momentarily diverted. Learners need to decide whether or not a distraction warrants further attention or action on their part. Once this has been decided, the learners either turn their attention back to what they were doing, or act on the distraction.

An interruption is an unexpected event for which the learner voluntarily suspends performance of one task in order to complete a different one. Interruptions are a significant source of errors and learners need to be aware of the potential for errors caused by interruptions and develop procedures for dealing with them. A classic example is an interruption that occurs while a learner is following the steps in a written procedure or checklist. The learner puts down the checklist, deals with the interruption, and then returns to the procedure—but erroneously picks up at a later point in the procedure, omitting one or more steps.

Fixation and Inattention

Since human attention is limited in focus and highly prone to distraction, people are vulnerable to two other types of problems: fixation and inattention.

Fixation occurs when a learner becomes absorbed in performing one task to the exclusion of other tasks. Instructors see many examples of this in learner performance. Beginning instrument pilots characteristically fixate on particular instruments, attempting to control one aspect of their performance while other aspects deteriorate. Fixation on a task is often a sign that the task has not received enough practice in isolation. That is, the learner has not yet mastered the task well enough to perform it in addition to other tasks. Fixation can happen even when individual skills have been reasonably mastered, when learners have not yet learned the importance of managing their own limited attentional resources.